CLAIMS

What is claimed is:

1. A micro-mechanical device, comprising:

a first member comprising a conductive material and formed on a laminated substrate;

a second member formed on the substrate; and

an actuatable member comprising a conductive material, a first end and a second end, wherein the first end is coupled with the first conductive member and the second end is suspended above the second member, wherein the actuatable member is moveable in relation to the second member, and wherein the second member induces movement of the actuatable member.

2. The micro-mechanical device of claim 1, wherein the laminated substrate is a printed circuit board (PCB) substrate.

3. The micro-mechanical device of claim 1, wherein the second member induces movement of the actuatable member by an electrostatic force between the actuatable member and the second member.

4. The micro-mechanical device of claim 1, wherein the second member induces movement of the actuatable member by an electro-magnetic force between the actuatable member and the second member.

5. The micro-mechanical device of claim 1, wherein the second member induces movement of the actuatable member by a physical force resulting from thermal expansion of the second member.

6. The micro-mechanical device of claim 1, wherein the second member induces the actuatable member to move into electrical contact with the second member.

7. The micro-mechanical device of claim 1, wherein the second member induces the actuatable member to move into electrical contact with a third conductive member.

8. The micro-mechanical device of claim 1, wherein the movement of the actuatable member alters the capacitive coupling between the actuatable member and the second member.

9. The micro-mechanical device of claim 1, wherein the movement of the actuatable member alters the capacitive coupling between the actuatable member and a third member.

10. The micro-mechanical device of claim 1, wherein the movement of the actuatable member alters the magnetic coupling between the actuatable member and the second member.

11. The micro-mechanical device of claim 1, wherein the movement of the actuatable member alters the magnetic coupling between the actuatable member and a third member.

12. The micro-mechanical device of claim 1, wherein the second member is substantially covered with a insulator layer preventing the flow of direct current when the second member is physically coupled with the actuatable member.

13. The micro-mechanical device of claim 1, wherein the second member is substantially covered with an insulator layer preventing electrical coupling when the second member is in physical contact with the actuatable member.

14. The micro-mechanical device of claim 1, wherein the actuatable member is configured to capacitively couple with the second member when the electric potential between the actuatable member and the second member reaches a switch potential.

15. The micro-mechanical device of claim 1, comprising a means for guiding waves in a coplanar configuration.

16. The micro-mechanical device of claim 1, wherein a third conductive member is formed on the substrate and is electrically coupled to the second end of the actuatable member.

17. The micro-mechanical device of claim 16, wherein the first conductive member is formed at a first height, the second conductive member is formed at a second height and the third conductive member is formed at a third height and wherein the first and third heights are greater than the second height.

18. The micro-mechanical device of claim 16, wherein the first, second and third conductive members are all formed at substantially the same height.

19. The micro-mechanical device of claim 16, wherein the first, second and third members comprise a coplanar waveguide.

20. The micro-mechanical device of claim 16, wherein the first, second and third conductive members are electrically coupled with an antenna formed directly on the substrate.

21. A switch, comprising:

a first conductive member formed at a first height;

a second conductive member formed at a second height;

a third conductive member formed at a third height, wherein the third member is substantially covered with a insulator material and is located between the first and second members and wherein the first, second and third heights are substantially the same; and

an actuatable member coupled with the first member and second members and extending over the third member, the actuatable member capacitively coupling with the third member when the electric potential between the third member and the actuatable member reaches a switch potential.

22. A method of fabricating a micro-mechanical component on a substrate, comprising:

forming a first conductive member on a laminated substrate; and

depositing an insulator layer on the first conductive member at a temperature below the maximum operating temperature of the substrate.

23. The method of claim 22, wherein depositing an insulator layer comprises:

increasing the energy of a plasma by inductively coupling radio frequency energy into the plasma to create a higher energy plasma; and

depositing an insulator layer on the first conductive member with a plasma enhanced chemical vapor deposition process using the higher energy plasma.

24. The method of claim 22, further comprising:

depositing a polymer layer over the substrate; and

molding the polymer layer with a mold.

25. The method of claim 24, wherein the polymer layer is a photoresist layer.

26. The method of claim 24, wherein molding the polymer layer comprises:

elevating the temperature of the polymer layer past the glass transition point of the polymer layer; and

applying pressure to the polymer layer through the mold to form the polymer layer into a pre-determined shape.

27. The method of claim 24, wherein molding the polymer layer comprises:

elevating the temperature of the polymer layer past the glass transition point of the polymer layer; and

applying pressure to the polymer layer through the mold to planarize the surface of the polymer layer.

28. The method of claim 26, wherein molding the polymer layer comprises:

lowering the temperature of the polymer layer past the glass transition point of the polymer layer; and

polishing the polymer layer to planarize the surface of the polymer layer.

29. The method of claim 22, further comprising forming a first layer of an antenna on the substrate concurrently with forming the first conductive member..

30. The method of claim 22, further comprising forming a system component concurrently with forming the first conductive member.

31. A three-dimensional antenna, comprising:

a first conductive layer formed in a semi-circular pattern horizontally on a first side of a substrate; and

a second conductive layer formed horizontally on a second side of the substrate, comprising:

a horizontal wall portion having a first length;

a horizontal slot portion having a second length greater than the first length, wherein the second length corresponds to a first resonant frequency;

a first vertical wall portion having a third length;

a second vertical wall portion having a fourth length, wherein the first and second vertical walls are coupled with the first and second layers; and

a vertical slot portion having a fifth length greater than the sum of the third and fourth lengths, wherein the fifth length corresponds to a second resonant frequency.

32. The three-dimensional antenna of claim 31, further comprising a micro-mechanical switch configured to electrically alter the length of at least one portion of the antenna.

33. The three-dimensional antenna of claim 31, wherein the substrate is a printed circuit board (PCB) substrate.

34. The three-dimensional antenna of claim 31, wherein the substrate is a laminated substrate.

35. The three-dimensional antenna of claim 31, wherein the first vertical wall portion is formed in a via of the substrate.

36. The three dimensional antenna of claim 31, wherein the first conductive layer is coupled with a coplanar waveguide.

37. The three dimensional antenna of claim 31, wherein the second conductive layer is coupled with a coplanar waveguide.

38. The three dimensional antenna of claim 31, wherein the first conductive layer is coupled with a radio frequency micro-mechanical component formed on the same substrate as the antenna.

39. A method of fabricating an antenna on a printed circuit board (PCB) substrate, comprising:

forming a first conductive layer in a semi-circular pattern on a first plane of a PCB substrate;

forming a horizontal wall having a first length in a second conductive layer on a second plane of the PCB substrate;

forming a horizontal slot in the second conductive layer, the horizontal slot having a second length greater than the first length , wherein the second length corresponds to a first resonant frequency;

forming a first vertical wall having a third length in a first via; and

forming a second vertical wall having a fourth length in a second via, wherein the first and second vertical walls are coupled with the first and second layers and wherein the first and second vertical walls comprise a vertical slot having a fifth length greater than the sum of the third and fourth lengths, wherein the fifth length corresponds to a second resonant frequency.

40. The method of claim 39, wherein the step of forming a first conductive layer comprises wet etching a pre-existing conductive layer to leave the first conductive layer in a semi-circular pattern.

41. A radio frequency (RF) system, comprising:

an antenna formed on a printed circuit board (PCB) substrate; and

a micro-mechanical component formed on the PCB substrate, the micro-mechanical component electrically coupled to the antenna.

42. The system of claim 41, further comprising a coplanar waveguide electrically coupled to the antenna and the micro-mechanical component.

43. The system of claim 41, wherein the micro-mechanical component is a RF micro-mechanical switch modifying the resonant frequency of the coplanar waveguide when the switch switches.

44. A method of monolithically integrating a radio frequency (RF) micro-mechanical component and an antenna on a single printed circuit board (PCB) substrate, comprising:

forming an RF micro-mechanical component on a PCB substrate;

forming an antenna on the PCB substrate, wherein the antenna is electrically coupled to the RF micro-mechanical component.

45. The method of claim 44, further comprising forming a coplanar waveguide on the PCB substrate, wherein the coplanar waveguide electrically couples the antenna and the RF micro-mechanical component.

46. The method of claim 44, wherein the RF micro-mechanical component and antenna are formed by etching a pre-existing conductive layer on the substrate.

47. A method of planarizing a polymer layer, comprising:

depositing a polymer layer over the substrate; and

molding the polymer layer with a mold.

48. The method of claim 47, wherein the polymer layer is a photoresist layer.

49. The method of claim 47, wherein molding the polymer layer comprises:

elevating the temperature of the polymer layer past the glass transition point of the polymer layer; and

applying pressure to the polymer layer through the mold to form the polymer layer into a pre-determined shape.

50. The method of claim 47, wherein molding the polymer layer comprises:

elevating the temperature of the polymer layer past the glass transition point of the polymer layer; and

applying pressure to the polymer layer through the mold to planarize the surface of the polymer layer.

51. The method of claim 47, wherein molding the polymer layer comprises:

elevating the temperature of the polymer layer past the glass transition point of the polymer layer; and

polishing the polymer layer to planarize the surface of the polymer layer.

52. The method of claim 47, further comprising forming a system component concurrently with forming the first conductive member.

53. The method of claim 47, further comprising:

distributing a plurality of spacers over the substrate, wherein the spacers have a first height; and

molding the polymer layer with a mold such that the polymer layer is planarized at a height corresponding to the first height of the spacers.

54. The method of claim 53, further comprising partially baking the polymer layer prior to distributing the plurality of spacers.

55. The method of claim 47, wherein depositing the polymer layer comprises spin-coating the substrate with the polymer layer.

56. The method of claim 47, wherein molding the polymer layer further comprises applying heat to the polymer layer while molding the polymer layer.

57. The method of claim 47, further comprising removing the mold after the polymer layer has been planarized such that a substantial amount of the polymer layer does not stick to the mold.

58. A method of depositing an insulator layer on a low temperature substrate, comprising:

providing an antenna array distributed around the circumference of a tubular processing chamber;

providing a set of shielded magnets at the base of the processing chamber;

filling the processing chamber with a plasma;

inductively coupling power from a radio frequency source through the antenna array into the processing chamber such that the density of the plasma is increased; and

exposing a substrate to the high density plasma at a temperature in the range of 90-170°C and below the maximum operating temperature of the substrate such that an insulator layer is deposited on the substrate.

59. An electrical system, comprising:

a micro-mechanical device formed on a first side of a substrate; and

a control circuit coupled with a second side of the substrate, wherein the control circuit is electrically coupled with the micro-mechanical device by a via through hole in the substrate and wherein the control circuit is configured to control the micro-mechanical device.

60. The system of claim 58, wherein the micro-mechanical device comprises:

a first member comprising a conductive material;

a second member; and

an actuatable member comprising a conductive material, a first end and a second end, wherein the first end is coupled with the first conductive member and the second end is suspended above the second member, wherein the actuatable member is moveable in relation to the second member, and wherein the second member induces movement of the actuatable member.

61. The micro-mechanical device of claim 59, wherein the laminated substrate is a printed circuit board (PCB) substrate.

62. The micro-mechanical device of claim 59, wherein the second member induces movement of the actuatable member by an electrostatic force between the actuatable member and the second member.